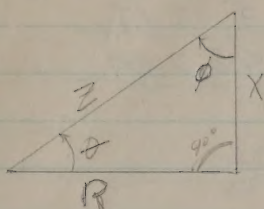




1-10

CHAPT. XXV - 1



SOLVING FOR

THIS TRIANGLE:

FIND THE UNKNOWN SIDES AND ANGLES

1 $R = 63.5, \angle = 25.0^\circ$

$$\tan 25^\circ = \frac{X}{63.5} = .466 \therefore X = 63.5 \times .466 = \underline{29.6} = X$$

$$\sin 25^\circ = \frac{29.6}{Z} = .4235 \therefore Z = \frac{29.6}{.4235} = \underline{70} = Z$$

$$\phi = 90 - 25 = \underline{65^\circ} = \phi$$

2 $R = 10.3, \angle = 78.5^\circ$

$$\tan 78.5^\circ = \frac{X}{10.3} = 4.92 \therefore X = 4.92 \times 10.3 = \underline{50.8} = X$$

$$\sin 78.5^\circ = \frac{50.8}{Z} = .9799 \therefore Z = \frac{50.8}{.9799} = \underline{51.7} = Z$$

$$\phi = 90 - 78.5 = \underline{11.5^\circ}$$

3 $R = 175, \angle = 12.3^\circ$

$$\tan 12.3^\circ = .216; 175 \times .216 = 37.8 = X$$

$$\sin 12.3^\circ = .213; 37.8 \div .213 = 178 = Z$$

$$\phi = 90 - 12.3 = \underline{77.7^\circ}$$

4 $R = .423, \angle = 64.9^\circ$

$$\tan 64.9^\circ = 2.134; .423 \times 2.134 = .903 = X$$

$$\sin 64.9^\circ = .905 \therefore Z = \frac{.903}{.905} = \underline{.998} = Z$$

$$\phi = 90 - 64.9 = \underline{25.1^\circ}$$

5 $R = 525, \angle = 37.4^\circ$

$$\tan 37.4^\circ = .764 \therefore X = 525 \times .764 = \underline{401} = X$$

$$\sin 37.4^\circ = .607 \therefore Z = 401 \div .607 = \underline{660} = Z$$

$$\phi = 90 - 37.4 = \underline{52.6^\circ}$$

6 $X = 48.4$, $\angle = 84.1^\circ$
 $\tan \angle 84.1^\circ = 9.676 \therefore R = 48.4 \div 9.676 = 5.0 = R$
 $\sin \angle 84.1^\circ = .9947 \therefore Z = 48.4 \div .9947 = 48.7 = Z$
 $\angle = 90 - 84.1 = 5.9^\circ$

7 $X = 9.21$, $\angle = 5.2^\circ$
 $\tan \angle 5.2^\circ = .091 \therefore R = 9.21 \div .091 = 101.2 = R$
 $\sin \angle 5.2^\circ = .0906 \therefore Z = 9.21 \div .0906 = 101.7 = Z$
 $\angle = 90 - 5.2 = 84.8^\circ$

8 $X = 867$, $\angle = 57.6^\circ$
 $\tan \angle 57.6^\circ = 1.578 \therefore R = 867 \div 1.578 = 550 = R$
 $\sin \angle 57.6^\circ = .8443 \therefore Z = 867 \div .8443 = 1025 = Z$
 $\angle = 90 - 57.6 = 32.4^\circ$

9 $X = 1250$, $\angle = 25.7^\circ$
 $\tan \angle 25.7^\circ = .482 \therefore R = 1250 \div .482 = 2600 = R$
 $\sin \angle 25.7^\circ = .434 \therefore Z = 1250 \div .434 = 2880 = Z$
 $\angle = 90 - 25.7 = 64.3^\circ$

10 $X = .29$, $\angle = 46^\circ$
 $\tan \angle 46^\circ = 1.038 \therefore R = .29 \div 1.038 = .28 = R$
 $\sin \angle 46^\circ = .72 \therefore Z = .29 \div .72 = .403 = Z$
 $\angle = 90 - 46 = 44^\circ$

11 $Z = 1.92$, $\angle = 40^\circ$
 $\cos \angle 40^\circ = .766 \therefore R = 1.92 \times .766 = 1.47 = R$
 $\tan \angle 40^\circ = .84 \therefore X = 1.47 \times .84 = 1.235 = X$
 $\angle = 90 - 40 = 50^\circ$

12 $Z = 1600$, $\angle = 73.5^\circ$
 $\cos \angle 73.5^\circ = .284 \therefore R = 1600 \times .284 = 454 = R$
 $\tan \angle 73.5^\circ = 3.375 \therefore Z = 454 \times 3.375 = 1534 = X$
 $\angle = 90 - 73.5 = 16.5^\circ$



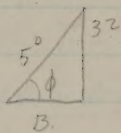
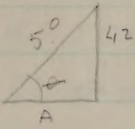
2-5-9-11

CHAPT - 25-2

2 $\tan \theta = \frac{4}{6} = .666 \quad \theta = 33.7^\circ$

5 $\tan \theta = \frac{600}{262} = 2.291 = \theta = 66.4^\circ$

9



$\sin \theta = \frac{42}{50} = .841 \quad \theta = 56.2^\circ$

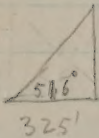
$\tan \theta = 56.2^\circ = 1.498; A = \frac{42}{1.498} = 28'$

$\sin \phi = \frac{32}{50} = .64 \quad \phi = 39.98^\circ$

$\tan \phi = 39.98 = .836 \quad B = \frac{32}{.836} = 38.3$

$28 + 38.3 = 66.3'$

11

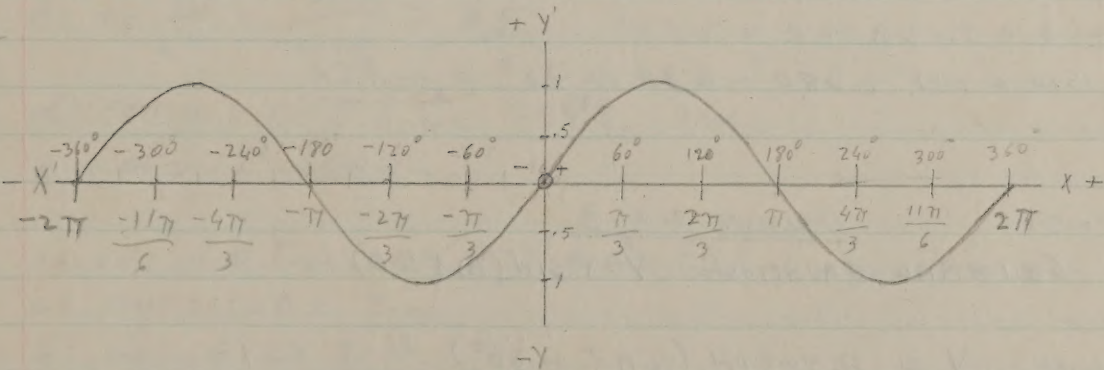


$\tan \theta = 51.6^\circ = 1.262 = W = 1.262 \times 325' = 410'$

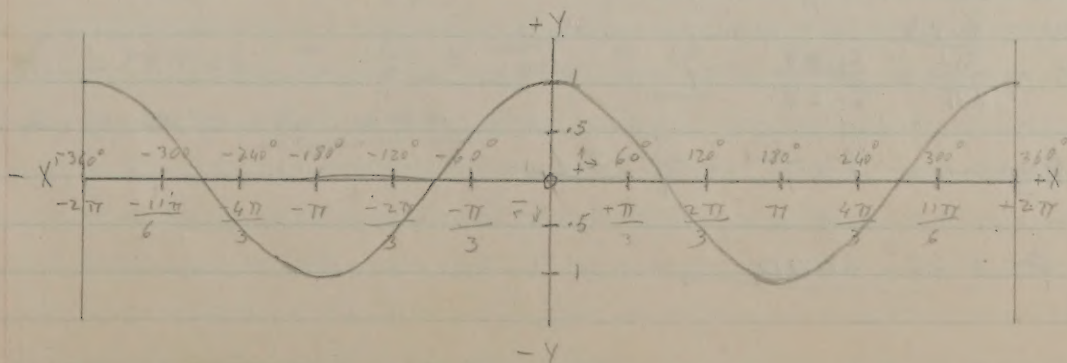
1-2

CHAPT - 26-1

1



2.



$$\perp a) 60 \times 60 \times 12 = 43200 \quad \frac{1}{432 \times 10^4} \times 2\pi = 1.458 \times 10^{-4} \text{ Radians/sec}$$

$$b) 60 \times 60 = 3600 \quad \frac{1}{3.6 \times 10^3} \times 2\pi = 1.74 \times 10^{-3} \text{ Radians/second}$$

$$c) \frac{1}{60} 2\pi = .105 \text{ Radians/second}$$

$$5) a) \theta = \omega t = .628 \text{ Radians}$$

$$\theta = .628 \times 57.3^\circ = 35.98^\circ$$

$$\sin \theta = 35.98^\circ = \underline{.586}$$

$$b) \theta = \omega t = 6.28 \times .3 = 1.884$$

$$\theta = 1.884 \times 57.3^\circ = 107.9^\circ$$

$$\sin \theta = 107.9^\circ = 180 - 107.95 = 72.05^\circ = \underline{.9516}$$

$$c) \theta = \omega t = 6.28 \times .65 = 4.08$$

$$\theta = 4.08 \times 57.3^\circ = 234^\circ$$

$$\sin \theta = 234^\circ = 180 - 234^\circ = -54^\circ = \underline{-.809}$$

$$d) \theta = \omega t = 6.28 \times .8 = 5.02$$

$$\theta = 5.02 \times 57.3^\circ = 288^\circ$$

$$\sin \theta = 288^\circ = 360^\circ - 288 = 72^\circ = \underline{.951}$$

$$\text{GENERAL EQUATION} = Y = r \sin(\omega t \pm \theta)$$

$$\perp \text{ SOLVE } Y = 25 \sin(2\pi t + 30^\circ)$$

$$a) r = \underline{25}$$

$$b) \omega = \underline{6.28}$$

$$c) f = \frac{\omega}{2\pi} = \frac{6.28}{6.28} = \underline{1}$$

$$d) \text{ PERIOD} = T = \frac{1}{f} = \frac{1}{1} = \underline{1}$$

$$e) \theta = \underline{30^\circ \text{ LEAD}}$$

CAPT-26-3 (CONT)GENERAL EQUATION: $y = r \sin(\omega t \pm \theta)$

2 SOLVE: $y = 32 \sin(37.7t - 10^\circ)$

a) AMPLITUDE: $r = 32$

b) $\omega = 37.7^\circ$

c) $f = \frac{\omega}{2\pi} = \frac{37.7}{6.28} = 6 \text{ SEC.}$

d) PERIOD: $T = \frac{1}{f} = \frac{1}{6} = .166$

e) $\theta = 10^\circ \text{ LAG}$

3 SOLVE: $e = 325 \sin(314t - 18^\circ)$

a) AMPLITUDE: $= 325$

b) $\omega = 314$

c) $f = \frac{\omega}{2\pi} = \frac{314}{6.28} = 50$

d) PERIOD: $T = \frac{1}{f} = \frac{1}{50} = .02 \text{ sec.}$

e) $\theta = 18^\circ \text{ LAG.}$

4 SOLVE: $e = E_m \sin(157t + 17^\circ)$

a) AMPLITUDE = E_m

b) $\omega = 157$

c) $f = \frac{\omega}{2\pi} = \frac{157}{6.28} = 25$

d) PERIOD: $T = \frac{1}{f} = \frac{1}{25} = .04 \text{ sec}$

e) $\theta = 17^\circ \text{ LEAD}$

5 SOLVE: $i = I_m \sin(6.28 \times 10^3 t - 90^\circ)$

a) AMPLITUDE = I_m

b) $\omega = 6.28 \times 10^3$

c) $f = \frac{\omega}{2\pi} = \frac{6.28 \times 10^3}{6.28} = 1000$

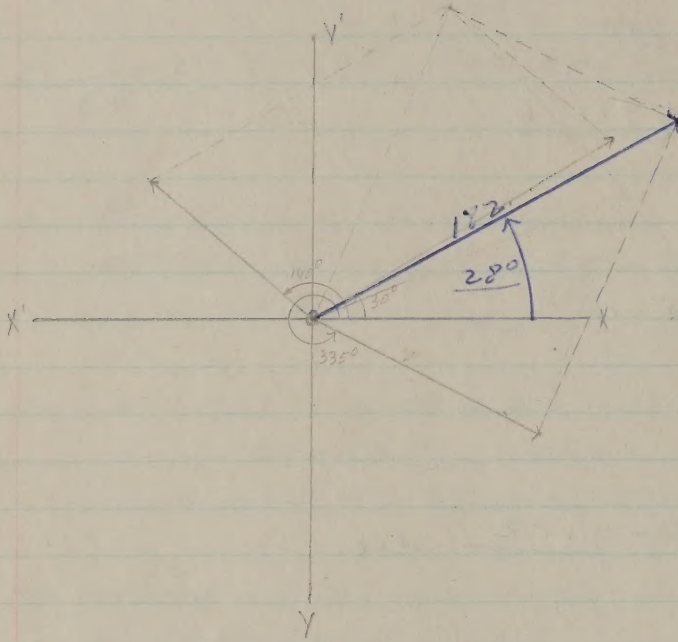
d) PERIOD: $T = \frac{1}{f} = \frac{1}{1000} = 10^{-3} \text{ sec.}$

e) $\theta = 90^\circ \text{ LAG}$

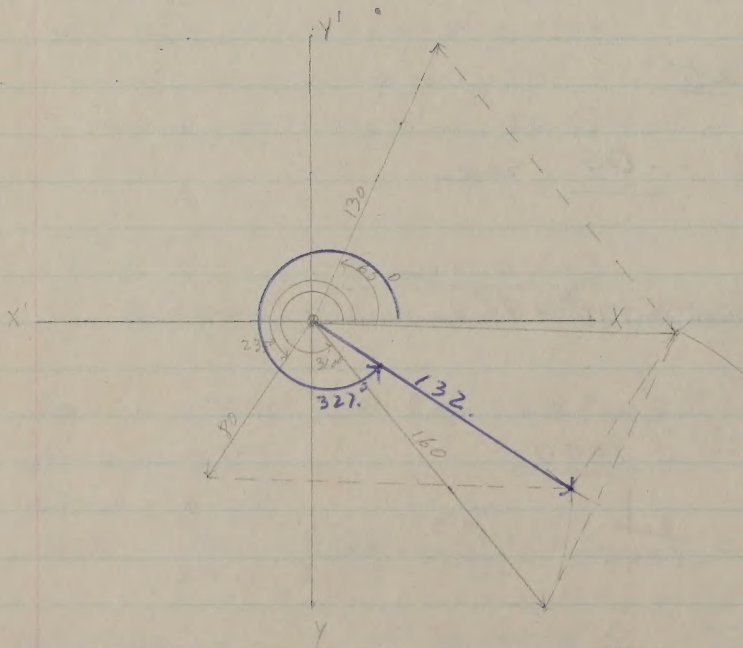
BL-1

CHAPT. 27-1

1



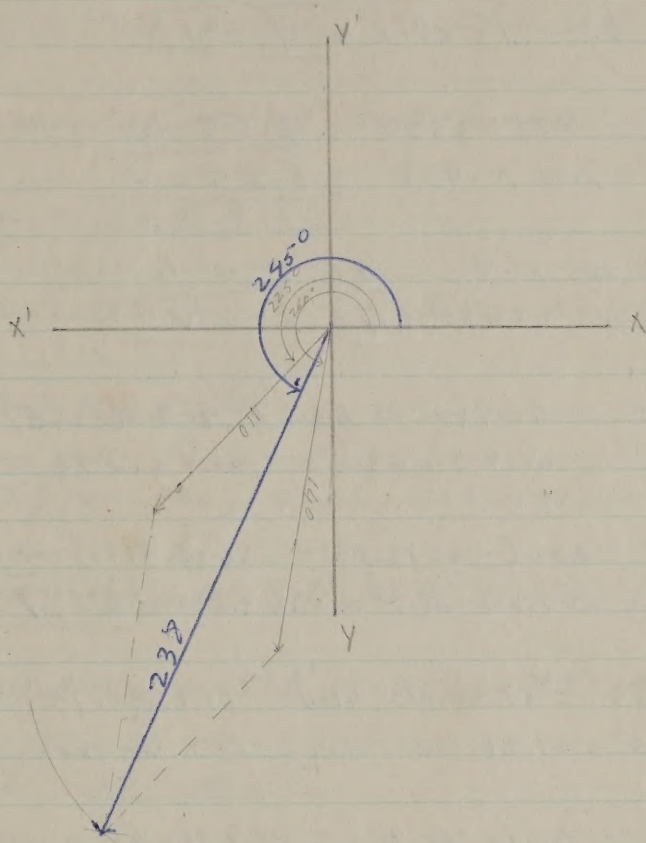
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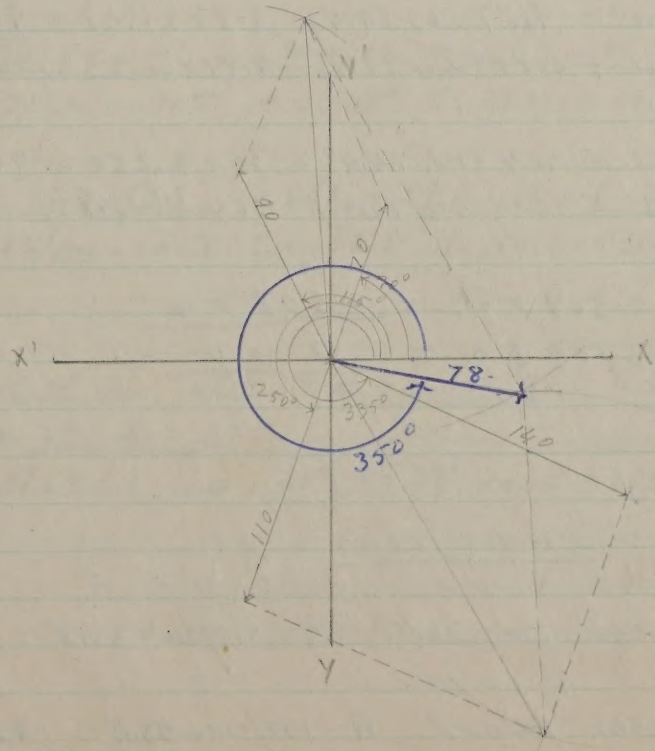


CHAPT-27-1 CONT

3



4



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CHAP-27-2

$$\underline{1} \quad h = 15 \cos 36.9^\circ = 15 \times .8 = \underline{12} = h$$

$$v = 15 \sin 36.9^\circ = 15 \times .6 = \underline{9} = v$$

$$\underline{3} \quad h = 7.15 \cos 69.1^\circ = 7.15 \times .356 = \underline{2.55} = h$$

$$v = 7.15 \sin 69.1^\circ = 7.15 \times .935 = \underline{6.65} = v$$

$$\underline{2} \quad h = 105 \cos 25.8^\circ = 105 \times .9 = \underline{94.5} = h$$

$$v = 105 \sin 25.8^\circ = 105 \times .435 = \underline{45.6} = v$$

$$\underline{4} \quad h = 40.9 \cos 116.5^\circ = 40.9 (-\cos 63.5^\circ) = 40.9 \times (-.45) = \underline{-18.2} = h$$

$$v = 40.9 \sin 116.5^\circ = 40.9 \sin 63.5^\circ = 40.9 \times .894 = \underline{36.6} = v$$

$$\underline{5} \quad h = 234 \cos 166.2^\circ = 234 (-\cos 13.8^\circ) = 234 \times (-.971) = \underline{-227} = h$$

$$v = 234 \sin 166.2^\circ = 234 \sin 13.8^\circ = 234 \times .238 = \underline{55.7} = v$$

$$\underline{6} \quad h = 61.2 \cos 221.4^\circ = 61.2 (-\cos 41.4^\circ) = 61.2 \times (-.75) = \underline{-46} = h$$

$$v = 61.2 \sin 221.4^\circ = 61.2 (-\sin 41.4^\circ) = 61.2 \times (-.66) = \underline{-40.4} = v$$

$$\underline{7} \quad h = 80.7 \cos 270^\circ = 80.7 (-\cos 90^\circ) = 80.7 \times (-0) = \underline{0} = h$$

$$v = 80.7 \sin 270^\circ = 80.7 (-\sin 90^\circ) = 80.7 \times (-1) = \underline{-80.7} = v$$

$$\underline{8} \quad h = 9.87 \cos 340.6^\circ = 9.87 \cos 19.4^\circ = 9.87 \times .948 = \underline{9.22} = h$$

$$v = 9.87 \sin 340.6^\circ = 9.87 (-\sin 19.4^\circ) = 9.87 \times (-.332) = \underline{-3.28} = v$$

$$\underline{9} \quad h = 364 \cos 285.1^\circ = 364 \sin 74.9^\circ = 364 \times .260 = \underline{94.8} = h$$

$$v = 364 \sin 285.1^\circ = 364 (-\sin 74.9^\circ) = 364 \times (-.965) = \underline{-351} = v$$

$$\underline{10} \quad h = 508 \cos 180^\circ = 508 \times -1 = \underline{-508} = h$$

$$v = 508 \sin 180^\circ = 508 \times 0 = \underline{0} = v$$

1-15

CHAPT 27-3

$$\underline{1} \quad \tan \theta = 5.8/9 = .644 \therefore \theta = 32.8^\circ, \quad R = 5.8/\sin \theta 32.8^\circ = 5.8/.542 = \underline{10.7 \text{ at } 32.8^\circ}$$

$$\underline{2} \quad \tan \theta = 145/108 = 1.342 \therefore \theta = 53.4^\circ, \quad R = 145/\sin \theta 53.4^\circ = 145/.804 = \underline{182 \text{ at } 53.4^\circ}$$

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CHAPT - 27 - 3 - CONT.

3 $\tan \theta = 44.5/12 = 3.71 \therefore \theta = 74.9^\circ$; $R = 44.5/\sin \theta = 44.5/\sin 74.9^\circ = 44.5/.965 = \underline{46.1 \text{ AT } 74.9^\circ}$

4 $\tan \theta = 234/730 = .321 \therefore \theta = 17.7^\circ$; $R = 234/\sin \theta = 234/\sin 17.7^\circ = 234/.305 = \underline{768 \text{ AT } 17.7^\circ}$

5 $18.3 + 8.2 = \underline{24.5 \text{ AT } 0^\circ}$

6 $\tan \theta = 21.5/80.2 = .268 \therefore \theta = 15^\circ$; $R = 21.5/\sin \theta = 21.5/\sin 15^\circ = 21.5/.259 = \underline{83 \theta (180 - 15) = 165^\circ}$

7 $30.6 + 13.4 = \underline{44 \theta 90^\circ}$

8 $\tan \theta = 42.1/50 = .844 \therefore \theta = 40.2^\circ$; $R = 42.1/\sin \theta = 42.1/\sin 40.2^\circ = 42.1/.645 = \underline{65.4 \theta (360 - 40.2) = 319.8}$

9 $\tan \theta = 110/32 = 3.44 \therefore \theta = 73.8^\circ$; $R = 110/\sin \theta = 110/\sin 73.8^\circ = 110/.96 = \underline{114.5 \theta (180 + 73.8) = 253.8}$

10 $\tan \theta = 201/117 = 1.72 \therefore \theta = 59.8^\circ$; $R = 201/\sin \theta = 201/\sin 59.8^\circ = 201/.864 = \underline{233 \theta (180 - 59.8) = 120.2^\circ}$

11 $108 - 92.6 = \underline{15.4 \theta 270^\circ}$

12 $46.2 + 38 = 84.2 \text{ AT } 0^\circ$; $\tan \theta = 71.4/86.2 = .844 \therefore \theta = 40.3^\circ$; $R = 71.4/\sin \theta = 71.4/\sin 40.3^\circ = 71.4/.646 = \underline{110.1 \text{ AT } 40.3^\circ}$

13 $78 - 46 = \underline{32 \text{ AT } 180^\circ}$; $49 - 19.7 = \underline{29.3 \text{ AT } 90^\circ}$
 $\tan \theta = 29.3/32 = .915 \therefore \theta = 42.5^\circ$; $R = 29.3/\sin \theta = 29.3/\sin 42.5^\circ = 29.3/.675 = \underline{43.5 \theta = 137.5}$

14 $239 - 56 = \underline{183 \text{ AT } 0^\circ}$; $201 - 89 = \underline{112 \text{ AT } 270^\circ}$
 $\tan \theta = 112/183 = .612 \therefore \theta = 31.5^\circ$; $R = 112/\sin \theta = 112/\sin 31.5^\circ = 112/.522 = \underline{214 \theta = 328.5^\circ}$

15 $13 + 15 = \underline{28 \text{ AT } 0^\circ}$; $21 + 25 = \underline{46 \text{ AT } 90^\circ}$; $4.8 + 69.2 = \underline{74 \text{ AT } 270^\circ}$
 $74 - 46 = \underline{28 \text{ AT } 270^\circ}$
 $\tan \theta = 28/28 = 1 \therefore \theta = 45^\circ$; $R = 28/\sin \theta = 28/\sin 45^\circ = 28/.707 = \underline{39.6 \theta (270 + 45 = 315)} \quad (360 - 45 = 315)$

ODD

CHAPT-28-1

E_m = MAXIMUM - e = INSTANTANEOUS VALUE

$$e = E_m \sin \theta$$

1 $e = E_m \sin 11^\circ = 325 \times .192 = \underline{62 \text{ V}}$

2 $e = E_m \sin 62^\circ = 325 \times .882 = \underline{286 \text{ V}}$

3 $e = E_m \sin 140^\circ = E_m \sin 40^\circ = 325 \times .644 = \underline{209 \text{ V}}$

4 $e = E_m \sin 243^\circ = E_m (-\sin 63^\circ) = 325 \times -.89 = \underline{-290 \text{ V}}$

5 $e = E_m \sin 340^\circ = E_m (-\sin 20^\circ) = 325 \times -.342 = \underline{-111 \text{ V}}$

3 $E_m = e / \sin \theta = 70 / \sin 61^\circ = 70 / .85 = \underline{80 \text{ V}}$

5 $I_m = i' / \sin \theta = 3.4 / \sin 13.4^\circ = 3.4 / .232 = 14.65 = I_m$

$i = I_m \sin \theta = 14.65 (-\sin 35^\circ) = 14.65 \times (-.573) = \underline{-8.4 \text{ A} = i'}$

7 $E_m = e' / \sin \theta = -117 / (-\sin 49^\circ) = -117 / (-.755) = \underline{155 = E_m}$

$e = E_m \sin \theta = 155 \sin 77^\circ = 155 \times .974 = \underline{151 \text{ V}}$

9 $\sin \theta = 22.5 / 100 = 2.25 = \underline{13^\circ}$

$360 - 13 = \underline{347^\circ}$ OR $180 + 13 = \underline{193^\circ}$

ODD

CHAPT-28-2

EQUATION FOR INSTANTANEOUS EME (e) - $e = E_m \sin \omega t$

1 a $F = \frac{12 \times 300}{60} = \underline{60 \text{ rps}}$; b $300 \times 12 \times 2 = \underline{7200}$

c $\omega = 2\pi \times 60 = 377 \text{ Radians}$

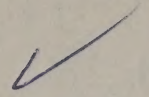
$e = 622 \sin 377 t$

3 a $\frac{25 \times 60}{250} = 6 \times 2 = \underline{12 \text{ POLES}}$; $\omega = 16.28 \times 25 = 157$

b $e = 433 \sin 157 t$

c $e = 433 (\sin 157 \times 1.005) = 433 \sin 1.57 \times 785 = \text{time } \theta \text{ IN RADIAN}$

$e = 433 \sin (.785 \times 57.3^\circ) = 433 \sin 45^\circ = 433 \times .707 = \underline{660 \text{ V}}$

CHAPT. 28-2 CONT

$$\underline{5} \quad 50 = \frac{12 \cdot X}{60} = 60 \times 50 = 12 \cdot X = \frac{60 \cdot 50}{12} = \underline{250 \text{ R.P.M.}}$$

$$\underline{7} \quad i = 14.1 \sin(2.23 \times 10^6) t; \quad 2.23 \times 10^6 = 2\pi F$$

$$\therefore F = \frac{2.23 \times 10^6}{2\pi} = \frac{2.23 \times 10^6}{6.28} = \underline{3.55 \times 10^5 = 355 \text{ Mc}}$$

$$\underline{9} \quad \omega = 6.28 \times 6 \times 10^7 = 3.76 \times 10^8$$

$$e = (5.5 \times 10^{-5}) \sin(3.76 \times 10^8) t$$

ODD

CHAPT 28-3-

$$\underline{1} \quad 600 \times .637 = 382.2 \text{ V}$$

$$44 \times .637 = 28.1 \text{ V}$$

$$\underline{3} \quad 4.2 / .637 = \underline{6.6 \text{ A.}}$$

$$\underline{5} \quad 440 \times 1.41 = 620 \text{ V}$$

$$\underline{7} \quad E_{AV} = 38.5 \times 1.41 \times .637 = 34.8 \text{ V}$$

$$\underline{9} \quad I_{AV} = 7.5 \times 1.41 \times .637 = 6.75 \text{ A}$$

ODD

CHAPT - 28-4-

$$\underline{1} \quad E_m = 9330$$

$$I_m = 1410 \quad \underline{a} \quad i = 1410 \sin(3.77t + 40^\circ)$$

$$F = 60 \sim$$

$$\theta = 30^\circ \text{ I LEAD} \quad \underline{b} \quad i = I_m \sin(\phi + \theta) =$$

$$\phi = 20^\circ \text{ V.} \quad \quad \quad = 1410 \sin(20^\circ + 30^\circ) =$$

$$\quad \quad \quad = 1410 \sin(+50^\circ) =$$

$$\quad \quad \quad = 1410 \times (.765) = 1080 \text{ A}$$

$$\underline{3} \quad i = I_m \sin(\phi + \theta) = 1410 \sin(190 + 30) = \\ = 1410 \sin(220 - 170) = 1410(-\sin 40^\circ) = 1410 \times .642 = \underline{906A}$$

$$\underline{5} \quad E_m = 2300 \times 1.414 = 3252V \quad i = I_m \sin(\omega t - 25^\circ)$$

$$I_m = 200 \times 1.414 = 283A \quad \omega = 6.28 \times 50 = 314$$

$$F = 50 \sim$$

$$\theta = 25^\circ \text{ LAG.}$$

$$\phi = 70^\circ \text{ E.}$$

$$a = 283 \sin 314t - 25^\circ$$

$$b = i = I_m \sin(\phi - \theta) =$$

$$= 283 \sin 70^\circ - 25^\circ =$$

$$= 283 \sin 45^\circ = 283 \times .706 = \underline{200A}$$

$$\underline{7} \quad E\theta = \sin 66.4/170 = .39 \angle = 23^\circ$$

$$I\phi = \sin 30/42.4 = .71 \angle = 45^\circ$$

$$\text{PHASE ANGLE} = 45^\circ - 23^\circ = 22^\circ \text{ I LEADS.}$$

$$\underline{9} \quad E_m = 230 \times 1.414 = 325.22$$

$$I_m = 30 \times 1.414 = 42.42$$

$$E\theta = -67.6/325.22 = .209 \angle -12^\circ$$

$$I\phi = 26.1/42.42 = .615 \angle 38^\circ$$

$$38 + 12 = 50^\circ \text{ LAG OR LEAD}$$